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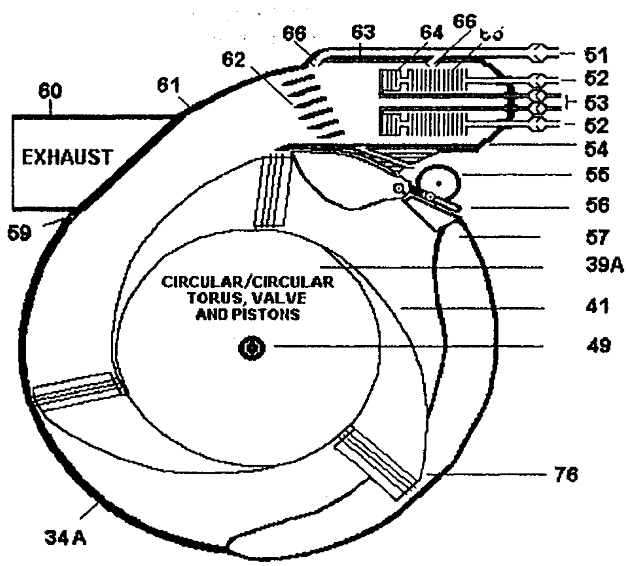

(57) Abstract

A revolving piston rotary toroidal cylinder valved expandable chamber device, compressor and engine machine system with an outer toroidal cylinder housing assembly (34A) having a central axis, having one or a plurality of balanced pistons (40) with means for attachment to a rotor and radiating through the outer rotor assembly to contact the interior surface of the outer housing at the other extreme of the pistons, whereby a plurality of relatively air tight compartments are formed between the interior surface of the outer housing, the outer surface of the rotor assembly and the piston or plurality of pistons with the volume of said compartment varying as a function of the rotative position of the inner cylinder and rotor assembly in relation to an isolating valve (56, 67).

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ROTARY PISTON ENGINE, PUMP AND MOTOR

Background--Field of Invention

This invention in its embodiment as an internal combustion engine would be the first truly significant new rotary internal combustion engine design since the invention of the Otto cycle engine by the German engineer, Nikolaus August Otto in 1861. This was followed by the invention of the diesel engine by the German engineer, Rudolf Diesel in 1896. Both of the latter are still basically the same design; four and two cycle reciprocating pistons. These two men changed the form of transportation for the entire world. Then came the Wankel off center "rotary" engine (not a true rotary) where the piston is basically a round cornered triangle but still a four cycle engine invented by the German, Felix Wankel in 1954. Prior to Mr. Wankel, the Englishman, Mr. Frank Whittle invented the jet turbine engine in 1930. The RP-7V revolving piston rotary internal combustion engine overcomes the limitations of gasoline as a fuel and combines the positive displacement of the conventional Otto cycle engine with the dynamic effect of a jet turbine engine yielding high torque at low and high rpm. This motor is a new technology that would not displace the current fuel supply infrastructure (it would utilize ordinary gas stations). With the steam power assist unit this engine would be the most adiabatic engine to date. This engine could better utilize available fuels including renewable fuel sources.

Objects and Advantages

A. This invention in its embodiment as an engine is more efficient for the following reasons:

1. It is perfectly rotary (unlike the Wankel engine).
2. It combines the positive displacement of a conventional internal combustion engine with the dynamic effect of a jet turbine engine.
3. Utilizes, does not waste low pressures (contrary to the minimum pressure required by a turbine.
4. Does not utilize a reciprocating motion that wastes energy changing directions (momentum, impetus, inertia).
5. Does not waste energy in cycles such as the four (4) and two (2) cycles of the conventional Otto, Diesel or Wankel engines. In the four (4) cycle engine only one (1) out of four (4) cycles provides power.
6. Does not waste power on a compression cycle.
7. Does not waste power on conventional cam shafts.
8. Does not waste power on conventional valves and springs.
9. Can function without a starter.
10. It can utilize excess heat that would normally be wasted (steam power assist and Thermoelectric devices). In conventional engines the radiator wastes 33% of the fuel's energy (more adiabatic).
11. Utilizes turbo charger(s) to supply oxidizer (air).
12. Utilizes electric fuel pump.
13. Utilizes flywheel effect.
14. Can utilize ultra high efficiency lubricants permanently bonded to critical surfaces with coefficients of friction of only 0.001 as opposed to the conventional 1.0.
15. The possible combinations of various versions that increase efficiency.
16. Design permits the complete control of ratios of fuel to air.

17. Can be combined with electric motor/generator in a hybrid configuration.
18. Because of the nature of the combustion there is no such thing as detonation, piston knock or pre-ignition. This engine compensates for the deficiencies or limitations of gasoline as a fuel. These being: ratios of air to fuel, its relatively low octane content and the tendency for gasoline to produce detonations, piston knock or pre-ignition.
19. Can use many types of fuel.
20. Utilizes gasoline more efficiently.
21. Is simpler in construction.
22. Has very few moving parts (only two in its basic configuration).

B. This engine is more durable for the following reasons:

1. Simple design, less moving parts, smaller, lighter, oblique angles.
2. Rotation only in one direction avoids wear caused by changing directions (180 degrees) on the parts. Reciprocating action tends by its nature to hammer the following parts: connecting rods, rings, bushings, bearings, cam shafts, cams, cylinders, pistons, crank shafts, etc.
3. Permits superior design and function of the piston rings because of one way rotation.
4. Less vibrations.
5. Utilizes ultra high efficiency lubricants permanently bonded to the critical surfaces.
6. Forms strong components geometrically designed for maximum strength (toroids and cones).
7. Controlled operating conditions of the critical parts.
8. Can utilize new materials such as carbon carbon composites that can resist higher temperatures yet do not expand as much as metal permitting smaller tolerances at the same time being stronger and more malleable.
9. Because of the nature of the design of the engine and its form of combustion there never is ping,

piston knock or detonation. These being potentially the most destructive for a conventional engine. Piston knock or detonation is a form of abnormal combustion, hot gases left over from the previous combustion spontaneously detonate. This knock produces a spike of ultra high pressure, a shock wave that can break pistons or rings and radically increase combustion chamber temperature. This increases the possibility that red-hot glowing metal in the combustion chamber will result in pre-ignition, at which point successive combustion events are ignited not by the spark plug, but by the hot spots. Timing is then completely out of control, leading to further temperature rises and the possibility of melted pistons etc.

C. This engine is easier to manufacture for the following reasons:

1. The toroid cylinder is manufactured in two halves, then is put together with gaskets and bolts etc.
2. The water jackets are manufactured and put together in the same way as the cylinders and bolted on over the latter.
3. The design is simple.
4. Can utilize new materials and simplified methods.
5. Would be more economical to manufacture.

D. This invention in its embodiment as a pump, a power assist device, a metering device, a water engine for hydro-electric purposes, a steam engine and a quantum motor is more efficient, durable and easy to manufacture for the reasons stated above in its internal combustion mode except without a combustor and fuel supply.

Drawing figures

Fig.1 is a schematic isometric front view of one type of the RP-7V circular/circular (round) version toroidal cylinder assembly.

Fig.2 is an exploded view of Fig. 1, including front and back of two pistons mounted on the rotor. Also showing bearings and axle shaft.

Fig.3 is a side view of a three piston round version with attached combustor and double inner reaction cages. A continuous internal combustion engine mode, including valve for round piston with counter balanced actuator lever, diffuser, primary and secondary air supply lines all with pressure and check valves. Also shown are exhaust port and manifold.

Fig.4 is a detailed side view of a three piston rectangular toroid cylinder and piston valved version of the internal combustion engine. Embodiments showing exhaust port, manifold and purge tube, turbinal type regenerative fuel line, primary and secondary air supply lines with check valves, electric air pump, reserve air tank, supercharger, rotor and axle.

Fig. 5 is an internal combustion engine in which the pistons and cylinder are of the rectangular version and the engine is positioned so as the roller tipped valve is free (no actuator), gravity balanced to where the force of combustion keeps the valve pressed against the slopped back surface of the piston. Also shown: combustor, diffuser, exhaust port/manifold and rotational direction.

Fig.6 is a detailed side view of the invention in a double independent valve circular/circular (round) toroid and piston configuration. In this round air lock type version there is always a closed valve after the passage of the piston completely sealing the retrograde escape of gases, etc. This and its single valve version, as well as its rectangular and other shaped versions are also a preferred embodiment of the invention as a pump, a power assist device, a metering device, a water engine for hydro-electric purposes, a steam engine and a quantum motor. All of the above in any size. Adding a combustor and moving the exhaust port would convert this version into an internal combustion engine.

Fig. 7 is the same as Fig. 6 but with a rectangular two piston and toroid version. The added combustors and exhaust port position portrays it in an internal combustion engine

configuration.

Fig. 8 is one of the pump embodiments of the invention in its basic structure only that this version has a reversed valve that can have a roller bearing type tip allowing it to ride the sloped

back of the piston(s) and as it does the quickly decreasing volume forces the air out of the exhaust port until the valve itself closes because of the piston's pressure. The shape of the valves may vary. In the exhaust port there may be a one way check or pressure valve. The pump embodiment may also take other forms or shapes (rectangular, oval, triangular, etcetera) or be in other versions such as the valve facing the conventional direction controlled by various types of actuators to hold the valves in place, open or closed, in order for them to do their work. The sloped back of the piston may extend as much as up to the top or face of the previous or receding piston.

Fig. 8A includes all of the elements and descriptions of figure 8 except that it additionally contains an accumulator by-pass neck 61.

Fig. 9 is similar in basic design to the previous versions of round torus internal combustion engine version except that it shows additionally an exhaust purge tube that connects to the exhaust manifold. Oil and water lines feed through the axle shaft separately and into the rotor and piston heads. The oil then seeps out between the piston rings and in again through the inlets to be pumped down to the oil cooler to be recirculated. The coolant or water is routed through the piston and returned to be cooled and/or its steam to be collected. Also shown is a water cooled diffuser/steam generator, a steam or water recovery tube and a stylized turbo charger in the exhaust manifold. The combustor generates the gases that move the pistons and utilizes a turbinal regenerative cooler/heater that vaporizes the fuel while cooling the combustor..

Fig.10 through Fig. 15 shows the rotational sequence of the rotor and pistons in relation to the valve position.

Fig. 16 is a front edge on view of a version of the invention in its round piston cylinder configuration in which a different angle of the oil and water compartments is illustrated and their distribution through the axle shaft, rotor and through their various routes from reservoir

through their designed function, through their respective cooling processes and back again. Also shown is the way the combustor is attached to the toroid cylinder. This compound compartmentalized version is one of various configurations.

Fig. 17 is a color rendition of the invention in its embodiments as an internal combustion engine. It clearly shows the basic process that power this engine. Additionally it shows the fresh air/exhaust purge tube which allows a type of conditioning of the piston and cylinder area prior to its cycling back to its combustion position. It also shows a hot water or steam recovery line. In summary basically what this figure shows is the way that the combustor drives the piston and is isolated from retrograde flow and is exhausted through the exhaust port and manifold.

Fig. 18 is an exploded schematic isometric front view of the invention in a preferred embodiment

as an internal combustion engine in a rectangular/rectangular configuration whose exterior may be air cooled. The cooling vanes also act as bearing supports.

Fig. 19 is a side view of the above embodiment also showing that it is in a two piston rotor configuration and showing its fresh air exhaust purge system.

Fig. 20 is the same embodiment as Fig. 18 and Fig.19 only that it is in a round cylinder configuration.

Fig. 21 is also in an internal combustion embodiment except that this version is an air breathing or sucking version meaning that this version is not force fed air as the other continuous combustion models. As a consequence this model cycles between detonations in order to supply itself with the fresh air necessary for combustion. Additionally this model is also a double valve version in which the exhaust purge valve faces the opposite direction from the traditional piston isolating valve in this version as well as in others.

Fig. 22 the only difference in this embodiment of the round toroid cylinder engine is that it has a

small turbocharger that runs off of the exhaust purge to draw in fresh air to supplement the air in the combustor for combustion.

Figs. 23, 24, 25 and 26 are different views of the same engine and indicate that it is a round air

cooled toroid cylinder with optional covers that would either concentrate heat for steam generation or for converting it into a water cooled version and Fig 25 also helps one visualize what the exterior of this engine would look like.

Figs. 27, 28, 29 and 30 illustrate the same as Figs. 23, 24, 25 and 26 except in a rectangular toroid version with an extended exhaust port eliminating the need for a purge tube.

List of Reference Numerals

30. External support convex conical structure.
31. Ribbed external support heat transfer structure.
32. Internal support concave conical structure.
33. Ribbed internal support heat transfer structure and water jacket element.
34. Internal toroidal cylinder structure.

34A. Whole round toroidal cylinder assembly.

34B. Whole rectangular toroidal cylinder assembly.

34C. Outer bearing support/heat transfer structure.

35. Axle shaft area.
36. Outer bearing bevels (4).

36A. Inner bearing bevels.

37. Perimeter bolt holes.

37A. Perimeter bolts.

38. Outer cylinder ring seal grooves.

38A. Outer rotor ring seal grooves.

39. Rotor area.

39A. Rotor

40. Piston cylinder area.

40A. Concave piston top.

41. Slopped piston back.
42. Bearing.
43. Bearing retainer.
44. Inner cylinder ring seal groove.

44A. Inner rotor ring seal groove.

45. Inner ring seal.
46. Outer ring seal.
47. Inner bearing.

48. Outer rotor seal.
49. Axle shaft.
50. Inner bearing retainer seal.
51. Secondary air supply line with check valves.
51A. Secondary air intake with check valves.
52. Primary inner air supply line with check valves.
53. Fuel supply lines with check valves.
54. Combustor/combustion chamber.
55. Timing gear valve actuator.
56. Valve for round toroid cylinder (with counter balanced actuator lever and or roller tip.
56A. Valve for round toroid cylinder in a double valve configuration.
57. Exhaust port.
58. Piston top with enhanced rings.
59. Top seal point.
60. Exhaust manifold.
61. Accumulator by-pass neck.
62. Diffuser.
63. Combustor water jacket.
64. Regeneratively cooled/heated fuel supply turbinals.
65. Inner stratified flashover reaction cage.
66. Combustor intake low pressure valves.
66A. One way low pressure valves.
67. Valve for rectangular toroid cylinder (with counter balanced actuator lever and or roller tip.
67A. Valve for rectangular toroid cylinder in a double valve configuration.
68. Fresh air exhaust and purge.
69. Reserve air tank.
70. 12v. Electric air pump.
71. Supercharger.

72. Spark plug/electrode.
73. Piston roller bearing.
74. Hybrid diffuser / auxiliary air / water cooled steam generator.
75. Pump intake port.
76. Round piston assembly can include enhanced piston rings, concave top and slopped backs.
76A. Rectangular piston assembly can include enhanced piston rings, concave top and slopped backs.
77. Water or coolant line.
78. Waste gas purge tube.
79. Lube oil ducts with piston rings and supply lines.
80. Enhanced piston rings.
81. Reversed exhaust purge valve.
82. Stylized turbo charger.
83. Valve actuator lever.
84. Scaled piston.
85. Shock absorbing valve impact pad.
86. Valve pivot and water inlet.
87. Piston water supply.
88. Water or steam recovery line.
89. Mini turbo charger.
90. Covers.
91. Reinforced combustor mount frame.
92. Internal coolant reservoir.
93. Coolant pick up tube.
94. Thermoelectric condenser.
95. Coolant filler cap.
96. Radiator and fan.
97. Expansion chamber.

98. Oil filler cap.

99. Oil cooling system.

100. Oil reservoir.

101. Oil pick up tube with filter.

102. Valve shield.

Summary of Invention

In accordance with the present invention, a revolving piston, variably shaped toroidal cylinder valved expandable chamber device with an outer toroidal cylinder housing assembly connected to a valve that acts to isolate one or more matching variably shaped pistons which are attached to a central balanced rotor. The latter being attached to a central axle, supported by bearings and or bushings with an exhaust port's position determined by the amount of pistons contained on its rotor.

Descriptions—Fig. 1 through 30

The circular/circular (round) toroidal cylinder assembly **34A** in figure **1** represents the basic structure of the larger size embodiments of the invention, smaller sizes might simply be stamped or poured in one piece. In figure **1** the external support convex conical structure **30** and the ribbed external support heat transfer structure **31** can be one piece also the perimeter bolt holes **37**, the outer bearing bevels **36** and part of the axle shaft area **35** are part of this structure. The internal support concave conical structure **32** can be made in one piece along with the ribbed internal support heat transfer structure and water jacket element **33.** The internal toroidal cylinder structure **34** has a smooth inner surface and comprises the piston cylinder area **40**, the rotor area **39**, the outer **38** and the inner **44** ring seal grooves, the inner bearing bevels **36A** and part of the axle shaft area **35.** Referring to figure **2** and supplemental to figure **1** the concave piston face **40A**, the piston sloped back **41** attached to the rotor **39A** which is attached to the axle shaft **49** supported by the two inner **47** and two outer **42** bearings who are in turn held in place

by the retainers **43** and **50**. The outer rotor seal **48** protects the outer ring seal **46** which in turn surrounds the inner ring seal **45**. Figure **3** is one of the preferred embodiments of this invention

an internal combustion engine in the circular/circular torus **34A,** piston(s) **76** and valve(s) **56** configuration with one version of the appropriate counter balanced actuator lever and valve **56** actuator **55**, pistons **76** and combustor **54** attached to the cylinder **34A,** top seal point **59** . The combustor accumulator by pass-neck **61** attached to the combustor **54** comprising a diffuser **62**, double inner reaction flash over cages **65** with fuel regenerative turbinal heaters **64**, primary inner air supply lines with check valves **52** secondary air supply lines with check valves **51** and fuel supply lines with check valves **53** all supply lines with combustor intake low pressure valves **66.** Also attached at a position determined by the number of pistons in order to achieve dynamic balance is the exhaust port **57** and exhaust manifold **60**. Figure **4** also a preferred embodiment of the invention as is figure **3** an internal combustion engine only this version is of a rectangular torus **34B,** piston(s) **76A** and valve(s) **67**. Also shown fresh air exhaust purge **68** connected to cylinder **34B**, piston roller **73** on piston tips **76A.** Also

in this figure primary air supply **52** is connected to supercharger **71** and reserve air pressure tank **69** connected to **12** volt electric air pump **70** all of which seems to rest on combustor water jacket **63** and lastly for this figure attached to the combustor **54** and leading into the inner stratified flash over reaction cage **65** is spark plug/electrode **72**.

Figure **5** the engines position is what mainly differentiates it from figure **4** also included is the hybrid diffuser/auxiliary air/water cooled steam generator.

Figure **6** the only way that this version differs from previous versions of cylindrical/cylindrical (round) internal combustion engines is that it is a double valve version. Figure **7** differs from figure **6** only in that it is a two piston version in a rectangular configuration. Figure **8** this is a pump embodiment of the invention in a rectangular configuration also notice that the valve **67** is installed in a reverse manner that is it opens toward the approaching piston's **76A** sloped back **41** which in yet other versions can extend to the top of the receding piston **76A** and it may have a one way low pressure valve **66A** also notice pump intake port **75** its position and shape can vary.

Figure **9** embodies the internal combustion engine in its round configuration as stated in earlier figures, what is new about this figure is the waste gas purge tube **78**, valve pivot and water inlet **86**, piston water supply **87**, water recovery line **88** and stylized turbo charger **82**.

Figures **10, 11, 12, 13, 14** and **15** illustrate the rotational sequence of the rotor **39A** and the pistons **76** in relation to the position of the valve **67**.

Figure **16** is the front view of a preferred embodiment the internal combustion engine the reinforced combustor mount frame **91**, internal coolant reservoir **92**, includes coolant pick up tube **93**, coolant filler cap **95**, connected to the thermoelectric condenser **94**, connected to radiator and fan **96**, connected to expansion chamber **97**, next to perimeter bolts **37a**, oil filler cap **98** connects to oil reservoir **100**, connected to oil cooling system **99**, oil pickup tube **101**, connected to axle shaft **99**.

Figure **17** is a color representation of the continuous combustion engine embodiment of the invention as illustrated in figure **3** and figure **9** except that it additionally includes a valve shield **102** within the combustor **54**, a valved fresh air/ exhaust purge **68** connected to the toroid cylinder **34** and a water or steam recovery line **88**.

Figure **18** is an exploded schematic isometric front view of the invention in a preferred

embodiment as a continuous internal combustion engine in a rectangular toroidal cylinder **34B** configuration whose exterior may be air cooled utilizing an outer bearing support heat transfer structure **34C** and a combustor **54.**

Figure **19** is a side view of the above embodiment also showing that it is in a two piston **75A** rotor **39A** configuration and showing its fresh air **68** exhaust purge system **78.**

Figure **20** is the same embodiment as figures **18** and **19** except that it is in a round cylinder configuration.

Figure **21** is also an internal combustion engine embodiment except that this version is an air breathing or air sucking version not force fed air as other continuous internal combustion models. Illustrated are a combustor **54** including a spark plug or electrode **72**, a primary inner air supply line with check valves **52**, a secondary air supply line with check valves **51**, secondary air intake **51A.** Also included are two valve actuator levers **83**, a reversed exhaust purge valve **81**, scaled pistons **84** and **76A**, an exhaust port **57**, an exhaust manifold **60** and two shock absorbing valve impact pads **85.**

figure **22** is a rendition of the three piston **76** single rotor **39A** round configuration of the engine embodiment illustrating a small turbocharger **89** connected to the combustor **54** and to the round toroid cylinder assembly **34A.**

Figures **23, 24, 25** and **26** are different views of the same air cooled engine with three round pistons **75** connected to a rotor **39A** encased in a whole round toroidal cylinder assembly **34A** with a combustor **54** and optional covers **90** showing finished view of this engine with ribbed external support heat transfer structures **31** and attached exhaust port **57** and exhaust manifold **60** to waste gas purge tube **78** also with side view.

Figures **27, 28, 29** and **30** illustrate the same as figures **23, 24, 25** and **26** except in a rectangular toroid version with an extended exhaust port **57** and no purge tube **78.**

Operation-- Main Embodiments

Figure 1 is a schematic isometric front view of one type of the rp-7v circular/circular (round) version of the toroidal cylinder assembly **34A** which represents the basic structure of the larger size embodiments of the invention, smaller sizes might simply be cast or stamped in one piece. This invention in its embodiment as an internal combustion engine, a version of which is represented by combining figures 1, 2 and 3 which demonstrate the following: fuel is supplied by a high pressure fuel pump through the fuel supply lines with check valves **53** and the regeneratively cooled/heated fuel supply turbinals to the inner reaction cage **65** within the combustor **54** which is attached to the toroidal cylinder assembly **34A**, where it is impinged upon (preferably from the opposite direction) and mixed with air from the primary inner air supply lines with check valves **52** supplied by a supercharger **71** and/or a turbocharger **82** or even the inventions embodiment as a pump in this case an air pump Figs.5, 8 and 8A then ignited by a spark/electrode **72** (see figure 9) within the reaction cage **65**. At this point the mixture is considered rich to guarantee ignition. Once the combustion exits the inner reaction cage **65** it is mixed further with air that is supplied by the secondary air supply lines with check valves **51** and leaned out further enhancing combustion and minimizing the creation of hydrocarbons. At this point the combustion gases may flow through a diffuser **62** and through the combustor accumulator by-pass neck 61 and onto the piston top **58** with enhanced rings **58** in position to receive it forcing said piston forward as the valve **56** in its closed position prevents the retrograde exiting of gases and at the same time guarantees rotational direction. The gases continue expanding and pushing the piston **58** forward until it reaches the exhaust port **57**. The position of the exhaust port **57** on the toroid cylinder assembly **34A** is determined by the number of pistons **58** on the rotor **39a** needed to achieve dynamic balance. Once the piston **58** reaches the exhaust port **57** the piston **58** following it will simultaneously reach the top seal point **59** and the cycle will repeat itself. As the piston **58** reaches the exhaust port **57** and the exhaust empties into the exhaust manifold **60** it may power a turbo charger **82** and/or contain another water cooled diffuser that further extracts

heat from the flow in order to supply supplemental steam power or for thermoelectric extraction. At this point an electrogasdynamic device (EGD from MHD) may be added under certain conditions to produce electric power. Figure 4 functions in the same way as the previous only that it is in the rectangular configuration as it would function in any shape be it oval or triangular etcetera.

Figure 5 also in a rectangular configuration would function in a similar way the only difference being the engine's position relative to the others. With the combustor **54** facing vertically the effect of gravity on the valve **67** can be practically eliminated.

Figure 6 in most aspects like the previous versions only that this version has a double valve **67A** air lock type configuration that assures an even better lock out of retrograde exhaust flow. is a detailed side view of the invention in a double independent valve circular/circular (round) toroid and piston configuration. In this round air lock type version there is always a closed valve after the passage of the piston completely sealing the retrograde escape of gases, etc. This and its single valve version, as well as its rectangular and other shaped versions are also a preferred embodiment of the invention as a pump, a power assist device, a metering device, a water engine for hydro-electric purposes, a steam engine and a quantum motor. All of the above in any size. Adding a combustor and moving the exhaust port would convert this version into an internal combustion engine

Figure 7 same double valve **67A** as figure 6 only in a rectangular torus **34B** configuration.

Figure 8 is the invention in one of its embodiment as a pump the main differences here being the lack of a combustor **54** replaced by inlet **75** and a reversed valve **67** that is a valve that faces and opens toward the rotation of the pistons **76A** and rotor **39A** riding or rolling on said rotor and sloped back pistons **41** thereby decreasing the chamber volume and forcing the air or water etc. to exit exhaust port **57** and exhaust manifold **60** until valve **67** closes the exhaust manifold **60** may contain a one way low pressure valve **66A**.

Figure 8A is the same basic design and function as fig. 8 except that valve **67** does not seat and close completely against the interior of rectangular toroidal cylinder assembly **34B** allowing working fluid or air to pass by more dynamically utilizing the accumulator by pass neck **61** the pressurized fluid or air is then trapped the one way low pressure valve **66A**.

Figure 9 is similar in basic design to the previous versions of round torus internal combustion engine version except that it shows additionally an exhaust purge tube **78** that connects to the exhaust manifold **60.** Oil **79** and water **87** lines feed through the axle shaft **49** separately and into the rotor **39A** and piston heads **76**. The oil then seeps out between the piston rings **58** and in again through the oil inlets **79** to be pumped down to the oil cooler **99** to be recirculated. The coolant or water is routed through the piston **76** and returned to be cooled and/or its steam to be collected. Also shown is a water cooled diffuser/steam generator **62**, a steam or water recovery tube **88** and a stylized turbo charger **82** in the exhaust manifold **60**. The combustor **54** generates the gases that move the pistons **76** and utilizes a turbinal regenerative cooler/heater **64** that vaporizes the fuel while cooling the combustor **54**. Also this version may utilize a pivoting water cooled valve **56** and valve pivot and water inlet **86.**

Figures 10, 11, 12, 13, 14 and 15 represent the rotational sequence of the rotor **39A** and pistons **76A** in relation to the position of the valve **67** in most embodiments of the invention.

Fugure 16 is a isometric schematic front edge on view of a version of the invention in its round piston cylinder **76** configuration in which a different angle of the oil **100** and water **92** reserve compartments is illustrated and their distribution through the axle shaft **49**, rotor **39A** and through their various routes from reservoir through their design function, through their respective cooling processes oil **99** and coolant or water expansion chamber **97**, radiator and fan **96**, thermoelectric condenser **94** and back again. Also shown is the way the combustor **54** is attached to the toroid cylinder **34A**. This compound compartmentalized version is one of various configurations.

Figure **17** is a color rendition of the invention in it's embodiment as an internal combustion engine. It clearly shows the basic process that powers this engine. Additionally it shows the fresh air/exhaust tube **68** which allows a type of conditioning of the piston **76** and cylinder area **34** prior to its cycling back to its combustion position. It also show a hot water or steam recovery line **88**. In summary basically what this figure shows is the way that the combustor **54** drives the piston **76**, is isolated from the retrograde flow by the valve **56** and is exhausted through the exhaust port **57** and manifold **60**.

Fig. 18 is an exploded schematic isometric front view of the invention in a preferred embodiment as an internal combustion engine in a rectangular/rectangular configuration whose exterior may be air cooled. The cooling vanes **34C** also act as bearing supports.

Fig. 19 is a side view of the above embodiment also showing that it is in a two piston **76A** rotor **39A** configuration and showing its fresh air **68** exhaust purge **78** system.

Fig. 20 is the same embodiment as Fig. 18 and Fig.19 only that it is in a round cylinder configuration.

Fig. 21 is also in an internal combustion embodiment except that this version is an air breathing or sucking version meaning that this version is not force fed air as the other continuous combustion models. As a consequence this model cycles between detonations in order to supply itself with the fresh air necessary for combustion. Additionally this model is also a double valve **67** & **81** version in which the exhaust purge valve **81** faces the opposite direction from the traditional piston isolating valve **67** in this version as well as in others. As the piston **76A** cycles around as shown in this figure the exhaust purge valve **81** and the valve **67** create a partial vacuum causing secondary air intake with check valves **51A** to draw air into that space. The continuing rotation and the closing of valve **67** cause air to be forced through the secondary air supply line with check valves **51** and into the combustor **54** combining with fuel in the inner reaction cage. At the same time the preceding piston **76A** is expanding the chamber outside the area isolated by the two valves drawing in air through the primary inner air supply with check valves **52** mixing it with fuel within the inner stratified flashover reaction cage **65.** At this time the spark plug/electrode **72** flashes and the mixture is ignited forcing the rotor **39A** and pistons **76A** to turn. This turning evacuates the exhaust gases through the exhaust port **57** and manifold **60** initiating the process all over again.

Fig. 22 the only difference in this embodiment of the round toroid cylinder engine is that it has a small turbocharger **89** that runs off of the purged exhaust gases to draw in fresh air to supplement the air in the combustor **54** for combustion.

Figs. 23, 24, 25 and 26 are different views of the same engine and indicate that it is a round air cooled toroid cylinder with optional covers **90** that would either concentrate heat for steam

generation or for converting it into a water cooled version and Fig 25 also helps one visualize what the exterior of this engine would look like.

Figs. 27, 28, 29 and 30 illustrate the same as Figs. 23, 24, 25 and 26 except in a rectangular toroid version with an extended exhaust port **57** eliminating the need for a purge tube **78**.

Conclusion, Ramifications and Scope

This invention in its internal combustion mode is more efficient due to the following reasons: It is a rotary engine in it's purest form. It does not waste energy in useless vibration caused by off center rotation. It runs on a single cycle; that is, there is no compression cycle, no separate exhaust cycle and no separate intake cycle. Just basically one cycle that does most of the above at the same time. This engine can use almost any kind of combustible liquid or gas, even adding water to certain fuels would function. This engine overcomes the limitations of gasoline as a fuel while being more efficient in its use. This invention is more durable due to its simple design with very few moving parts (only two in its basic configuration). This invention is also easier to manufacture because it can be made stamped or cast in two halves, then bolted together or joined in some other way. Making it not only easier to build but also more economical.

The invention can be used in many ways. The following is a list of and function of some of its embodiments. Its embodiment as a very efficient internal combustion engine is well documented in these pages, so I will go on to mention some of the others. One of its versions in its internal combustion engine embodiment is that of an air breathing engine. That is an engine that sucks in the air that it will utilize for combustion rather than having the air forced in by some other external mechanical means. In this version, the engine becomes a cycled engine in which not every passing of the piston is imparted by power but rather every other and the spark is timed in a manner as to coincide with this cycle, see Fig. 21. This is one of various versions of this type of air breathing engine. In its embodiment as a pump, as illustrated in Fig. 8, this embodiment can be made in many ways. Fig. 8 shows the invention in a two square piston and cylinder configuration with a reversed valve (67). In other versions of this pump the valve need not be reversed. It can be double, it can have one or a plurality of pistons and rotors and may or may not include a one way pressure valve (66A). It can come in all sizes from nano or micro to macro or gigantic and it can be manufactured of any material that is suitable to its ultimate purpose (metal, ceramics, composites, etc.).

The valve(s) in the designs of the pump embodiments, open and close allowing the passage of a piston yet isolating it and the working fluid from the exhaust manifold insuring that it does its work and flow only in one direction. Imparting power to the axle shaft will cause the rotor with the attached balanced pistons to turn. The inlet would draw the working fluid into the expanding chamber. Once the working fluid is drawn into the chamber it is compartmentalized and sealed in by the following piston which delivers it to the exhaust port where the valve(s) purge or force it out of the device. Figs 6, 8 and 8A function in this manner. The embodiments of the steam engine, the water engine (for hydroelectric and other purposes), the fluid metering devices , the power assist devices and the quantum motors would function in the same manner except that the working fluid would supply the force or pressure to move the piston(s) and the rotor and the rotational power would be derived from the shaft rather than be delivered to it as in the case of the pump. The valve with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a less obstructive position. From opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons and acting as a fluidic amplifier until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until when load increases or revolutions decrease for any reason then the valve can readily reengage and assume full range movement or operation.

As with all the valves in any embodiment of this invention are and can be actuated by many means they can spring loaded, cam and lever actuated with or without a controlling governor, electrically, pneumatically, hydraulically or mechanically actuated with electronic controls or other type controls In these illustrations the rotor and piston rotation is generally in a clockwise direction but in actuality may not be limited to this.

The above variations and variations not mentioned above whether in size, materials, embodiments and functions, represent the invention in all of its actual and potential manifestations.

What is claimed:

1. A revolving piston rotary toroidal cylinder valved expandable chamber device comprising :

an outer toroidal cylinder housing assembly having a smooth interior surface, connected to

a valve that acts to isolate one or a plurality of pistons within said toroidal cylinder housing, said pistons having means for attachment to

a central balanced rotor, said rotor having means for attachment to a central axle or crank shaft supported by a plurality of bearings and or bushings, and

an exhaust port with means for attachment to said outer toroidal cylinder housing.

2. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1, wherein said outer toroidal cylinder housing assembly, having a smooth interior surface, having said valve attached,

providing passage and isolation to said piston as a means for preventing retrograde escape of gases, fluid, water, steam and quanta and guaranteeing rotational direction, said gases, fluid, water, steam and quanta providing force to said piston isolated by said valve to turn said attached rotor whereby turning said axle or crank shaft,

providing support by said plurality of bearings and or bushings, said exhaust port having means for attachment to said toroidal cylinder, said pistons to be shaped with a gradually sloping back and conforming to the inner cylinder surface, therefore easing the evacuation of exhaust.

3. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1 further comprising:

pistons to be shaped with a gradually slopped back and conforming to the inner cylinder surface.

4. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1 further comprising:

a combustor and/or combustion chamber with method for igniting an internal combustion engine.

5. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1 wherein said device also comprises means for an internal combustion engine.

6. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1 wherein said device also comprises means for Fluid Metering devices.

7. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1 wherein said device also comprises means for Power Assist devices.

AMENDED CLAIMS

[received by the International Bureau on 24 March 2000 (24.03.00); original claims 1-7 replaced by amended claims 1-29 (14 pages)]

1. A rotary piston continuous flow dynamic displacement expandable chamber device comprising a hollow toroid cylinder housing or stator with a smooth inner surface, a rotor rotably mounted utilizing a crankshaft attached to said rotor in said cylinder, one or a plurality of pistons mounted radially on said rotor, an intake port with means for the attachment of an intake manifold, a movable conformably shaped and sized valve mounted near the opening of said intake port that does not ever fully close off said intake port yet functions to allow said piston to travel through while isolating the working fluid from a retrograde course to the exhaust port and allowing the continuous flow of fluid or combustion without interruption, with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a less obstructive position, from opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons and acting as a fluidic amplifier combining positive displacement with the dynamic effect until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until the load increases or revolutions decrease for any reason then the valve can readily re-engage as a fluidic amplifier or assume full range movement or operation, see conclusions, ramifications and scope page 22, an exhaust port with means for attachment to said toroid cylinder or stator housing for evacuating the working fluid after it has been used.

2. A rotary piston continuous flow dynamic displacement expandable chamber device according to claim 1, wherein said pistons have a plurality of enhanced piston rings mounted in grooves of said pistons.

3 A rotary piston continuous flow dynamic displacement expandable chamber device according to claim 1, wherein said pistons and said toroid cylinder housing or stator are permanently bonded with a lubricant.

4. A rotary piston internal continuous combustion dynamic displacement engine comprising a hollow conforming shape and sized toroid cylinder housing or stator with a smooth inner surface, a rotor rotably mounted utilizing a crankshaft attached to said rotor in said cylinder, one or a plurality of conforming shape and sized pistons mounted on said rotor, an intake port a with means for the attachment of an obliquely mounted combustor or combustors containing an inner reaction cage that produces controlled stratified flashover combustion as described in operation main embodiments, said combustor having the novel property of an instant two step passive compression process that is achieved by the unique design its inner reaction cage, reductions to its neck or nozzle, by its valve shield and diffuser, said combustor mounted at an oblique angle to said housing or stator, with means for supplying said combustor with fuel and air and means for igniting said mixture, said combustion providing both a

pressurized force and an impinging or impacting force on said pistons, said impinging force and overall device efficiency is enhanced by the design incorporating oblique angles, a movable conformably shaped and sized valve mounted near the opening of said combustor and intake port, that does not ever fully close off said intake port or combustor yet functions to allow said piston to travel through while isolating the combustion gases from a retrograde course to the exhaust port allowing the continuous flow of fluid or combustion without interruption, with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a less obstructive position, from opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons and acting as a fluidic amplifier combining positive displacement with the dynamic effect until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until the load increases or revolutions decrease for any reason then the valve can readily re-engage as a fluidic amplifier or assume full range movement or operation.

5. A rotary piston internal continuous combustion dynamic displacement engine according to claim 4, wherein said pistons have a plurality of enhanced piston rings mounted in grooves of said pistons and said pistons have concave tops.

6. A rotary piston internal continuous combustion dynamic displacement engine according to claim 5, wherein said pistons

and said toroid cylinder housing are permanently bonded with a heat insulating coating and permanently bonded lubricant.

7. A rotary piston internal continuous combustion dynamic displacement engine according to claim 4, wherein said toroidal cylinder housing or stator has a means for attaching an exhaust manifold to said exhaust port, a means for attaching an electro gas dynamic device to said exhaust manifold for the generation of electricity for use by the engine and for other uses.

8. A rotary piston internal continuous combustion dynamic displacement engine according to claim 7, wherein said toroidal cylinder housing comprises water jackets and water cooling systems, with means for attachment of steam extracting fittings and means for extracting steam from the process of cooling said engine and its components, utilizing said steam to aid in the process of power production either in the way of reintroduction of this steam into the combustor helping push the pistons or in a separate isolated process and additional device that imparts power to the common crankshaft with means for recovering said steam, cooling it, phase changing it back into liquid, circulating and reusing it.

9. A rotary piston dynamic displacement steam or fluid engine comprising a hollow conforming shape toroid cylinder housing or stator with a smooth

inner surface, a rotor rotably mounted utilizing a crankshaft in said cylinder with one or a plurality of radially mounted pistons of conforming shape with means for attachment to said rotor, an intake port on said cylinder housing or stator for the admission of steam or working fluid, an obliquely mounted intake housing with means for attachment to said toroid stator or housing, providing both a pressurized force and an impinging or impacting force upon the tops of said pistons, said impinging force and overall device efficiency enhanced by oblique angles, a conformably shaped valve mounted near the intake port within the intake port housing, said valve does not ever fully close off said intake port yet having the movement and function as to allow the pistons through yet isolate the steam or working fluid and preventing said fluid from a retrograde course out of the exhaust port, thereby allowing the continuous flow of said steam or fluid and with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a less obstructive position, from opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons acting as a fluidic amplifier combining positive displacement with the dynamic effect until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until the load increases or revolutions decrease for any reason then the valve can readily re-engage as a fluidic amplifier or assume full range movement or operation, thereby forcing the steam or working fluid to pressure and force the piston forward toward the exhaust port at which point the working fluid will exit the device and another piston will have moved up

to the seal point within the toroid cylinder or housing and said process will be repeated imparting a continuous rotational action to the rotor.

10. A rotary piston dynamic displacement steam or fluid engine according to claim 9, wherein said pistons have a plurality of enhanced piston rings mounted in grooves of said pistons.

11. A rotary piston dynamic displacement steam or fluid engine according to claim 9, wherein said toroid cylinder housing and pistons are permanently bonded with a heat insulating coating and permanently bonded lubricant.

12. A rotary piston dynamic displacement steam or fluid engine according to claim 9, with means for recovering used steam, cooling it and phase changing it back into liquid, circulating and reusing it.

13. A rotary piston expandable chamber dynamic displacement fluid metering device comprising a hollow conforming shape toroid cylinder housing or stator with a smooth inner surface, a rotor rotably mounted in said cylinder with one or a plurality of radially mounted pistons with means for attachment to said rotor, an intake port on said cylinder housing or stator for the admission of fluid utilizing the fluid's pressure into an expandable chamber of measured or predetermined volume limited by

the action of a conformably shaped valve mounted near the intake port within an obliquely angled intake port housing with means for attachment to said toroid cylinder housing or stator, providing both a pressurized force and an impinging or impacting force upon the tops of said pistons, said impinging force and overall device efficiency aided by oblique angles, said valve having the movement and function as to allow the revolving pistons through yet isolate the fluid and preventing it from a retrograde course out the adjacent exhaust port and with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a less obstructive position, from opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons acting as a fluidic amplifier combining positive displacement with the dynamic effect until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until the load increases or revolutions decrease for any reason then the valve can readily re-engage as a fluidic amplifier or assume full range movement or operation, thereby forcing said piston forward in a measured volume and out the exhaust port, whereby allowing said device to meter, measure or dispense specific units of measured volumes of fluid at either a very fast or slow rate in very large or small quantities.

14. A rotary piston expandable chamber dynamic displacement fluid metering device according to claim 13, wherein said pistons have a plurality of enhanced piston rings mounted in grooves of said pistons.

15. A rotary piston expandable chamber dynamic displacement fluid metering device according to claim 13, wherein said pistons and said toroid cylinder housing are permanently bonded with a heat insulating coating and permanently bonded lubricant.

16. A rotary piston expandable chamber dynamic displacement fluid metering device according to claim 13, wherein said device has means for the attachment and use of a counting apparatus.

17. A rotary piston dynamic displacement power assist device comprising a hollow conforming shape toroid cylinder housing or stator with a smooth inner surface, a rotor rotably mounted to a crankshaft in said cylinder or stator with one or a plurality of radially mounted pistons of conforming shape with means for attachment to said rotor, an intake port on said cylinder housing or stator for the admission of working fluid into an obliquely angled intake port housing providing both a pressurized force and an impinging or impacting force upon the tops of said pistons, said impinging force and overall device efficiency aided by oblique angles, said volume limited by the action of a conformably shaped valve mounted near said intake port within said intake port housing with means for attachment to said toroid cylinder housing or stator, said valve having the movement and function as to allow the revolving pistons through yet isolate the fluid and preventing it from a retrograde course out the adjacent exhaust port yet allows for the continuous flow of said fluid without

interruption, with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a less obstructive position, from opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons acting as a fluidic amplifier combining positive displacement with the dynamic effect until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until the load increases or revolutions decrease for any reason then the valve can readily re-engage as a fluidic amplifier or assume full range movement or operation, whereby forcing the piston forward by imparting pressure to said piston until it reaches the exhaust port turning said crankshaft.

18. A rotary piston dynamic displacement power assist device according to claim 17, wherein said pistons are grooved and have sealing rings.

19. A rotary piston dynamic displacement power assist device according to claim 17, wherein said pistons and said toroid cylinder housing are permanently bonded with a lubricant.

20. A rotary piston dynamic displacement hydraulic pump comprising a hollow conforming shape toroid cylinder housing or stator with a smooth inner surface, a rotor rotably mounted utilizing a powered crankshaft in said cylinder with one or a plurality of radially mounted pistons with means for attachment to said rotor, an intake port on said cylinder housing

or stator for the admission of hydraulic or working fluid, an obliquely mounted intake housing with means for attachment to said toroid stator or housing, a conformably shaped valve or valves as demonstrated in figs 2, 6, 8, and 8a mounted near the intake port, said port being within the intake port housing, overall device efficiency aided by oblique angles, said valve or valves having the movement and function as to allow the revolving pistons through yet isolate the hydraulic or working fluid and preventing it from a retrograde course out the adjacent exhaust port yet never fully closing off the flow through said intake port allowing the continuous flow of fluid without interruption, with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a less obstructive position, from opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons acting as a fluidic amplifier combining positive displacement with the dynamic effect until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until the load increases or revolutions decrease for any reason then the valve can readily re-engage as a fluidic amplifier or assume full range movement or operation, thereby forcing said hydraulic or working fluid to be pushed , pressured or forced by the piston forward toward the exhaust port at which point the working fluid will exit the device and another piston will have moved up to the seal point within the toroid cylinder or housing and said process will be repeated imparting a continuous fluid flow, whereby allowing said device to pump specific units of measured volumes of fluid at either a very fast or slow rate in very large or small quantities.

21. A rotary piston dynamic displacement hydraulic pump according to claim 20, wherein said pistons have a plurality of enhanced piston rings mounted in grooves of said pistons.

22. A rotary piston dynamic displacement hydraulic pump according to claim 20, wherein said pistons and said toroid cylinder housing are permanently bonded with a heat insulating coating and permanently bonded lubricant.

23. A rotary piston expandable chamber dynamic displacement bio-fluid or heart pump made of an inert nonbioreactive material comprising a hollow conforming shape toroid cylinder housing or stator with a smooth inner surface, a rotor of conforming shape rotably mounted utilizing a powered crankshaft in said cylinder housing with one or a plurality of radially mounted inertly lubricated modified pistons with means for attachment to said rotor, an intake port on said cylinder housing or stator for the admission of bio-fluid, blood, etcetera, an obliquely angled intake housing for reducing bio-fluid turbulence with means for attachment fusing or formed in one or several pieces to said toroid stator or housing, a conformably shaped valve or valves as demonstrated in figs 2, 6, 8, and 8a mounted near the intake port, said port being within said intake port housing, said valve or valves having the movement and function as to allow the revolving pistons through yet isolate the bio-fluid and preventing it from a retrograde course out the adjacent obliquely angled exhaust port, said valve never closing off flow through intake port allowing the

continuous flow of fluid without interruption , with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a less obstructive position, from opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons acting as a fluidic amplifier combining positive displacement with the dynamic effect until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until the load increases or revolutions decrease for any reason then the valve can readily re-engage as a fluidic amplifier or assume full range movement or operation, thereby forcing said bio-fluid to be pushed or forced gently by the piston forward toward the said exhaust port at which point the bio-fluid will exit the device and another or the same piston will have moved up to the dynamic seal point within the toroid cylinder or housing and said process will be repeated imparting a continuous smooth bio-fluid flow without undue agitation, whereby allowing said device to pump bio-fluids at a very fast rate in large volumes or a lower rate according to the needs of the body at the moment yet minimizing the effects of agitation and trauma on these fluids.

24. A rotary piston expandable chamber dynamic displacement bio-fluid or heart pump according to claim 23, wherein said pistons have one or a plurality of enhanced piston rings mounted in grooves of said pistons.

25. A rotary piston expandable chamber dynamic displacement

bio-fluid or heart pump according to claim 23, wherein said pistons and said toroid cylinder housing or stator are permanently bonded with an inert or non bioreactive lubricant.

26. A rotary piston expandable chamber dynamic displacement bio-fluid or heart pump according to claim 23, wherein said pump has means for detecting and controlling the body's need for variations in fluid flow.

27. A rotary piston expandable chamber dynamic displacement air pump comprising a hollow conforming shape toroid cylinder housing or stator with a smooth inner surface, a rotor rotably mounted utilizing a powered crankshaft in said cylinder with one or a plurality of radially mounted pistons with means for attachment to said rotor, an intake port on said cylinder housing or stator for the admission of air, gas or working fluid, an obliquely angled intake housing with means for attachment to said toroid stator or housing, a conformably shaped valve or valves as demonstrated in figs 2, 6, 8, and 8a mounted near the intake port, said port being within said intake port housing, said valve or valves having the movement and function as to allow the revolving pistons through yet isolate the air, gas or working fluid and preventing it from a retrograde course out the adjacent exhaust port yet said valve never closes off said intake port allowing the continuous flow of air, gas or working fluid without interruption, with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a

less obstructive position, from opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons acting as a fluidic amplifier combining positive displacement with the dynamic effect until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until the load increases or revolutions decrease for any reason then the valve can readily re-engage as a fluidic amplifier or assume full range movement or operation, thereby forcing said air, gas or working fluid to be pushed , pressured or forced by the piston forward toward the exhaust port at which point the air, gas or working fluid will exit the device and another piston will have moved up to the seal point within the toroid cylinder or housing and said process will be repeated imparting a continuous air, gas or working fluid flow, whereby said device may pump very large volumes of air at a very fast rate or very small amounts at a relatively slow rate making this device very flexible in its abilities to handle varied capacities.

28. A rotary piston expandable chamber dynamic displacement air pump according to claim 27, wherein said pistons have one or a plurality of piston rings.

29. A rotary piston expandable chamber dynamic displacement air pump according to claim 27, wherein said pistons and said toroid cylinder housing are permanently bonded with a lubricant.

FIG. 1

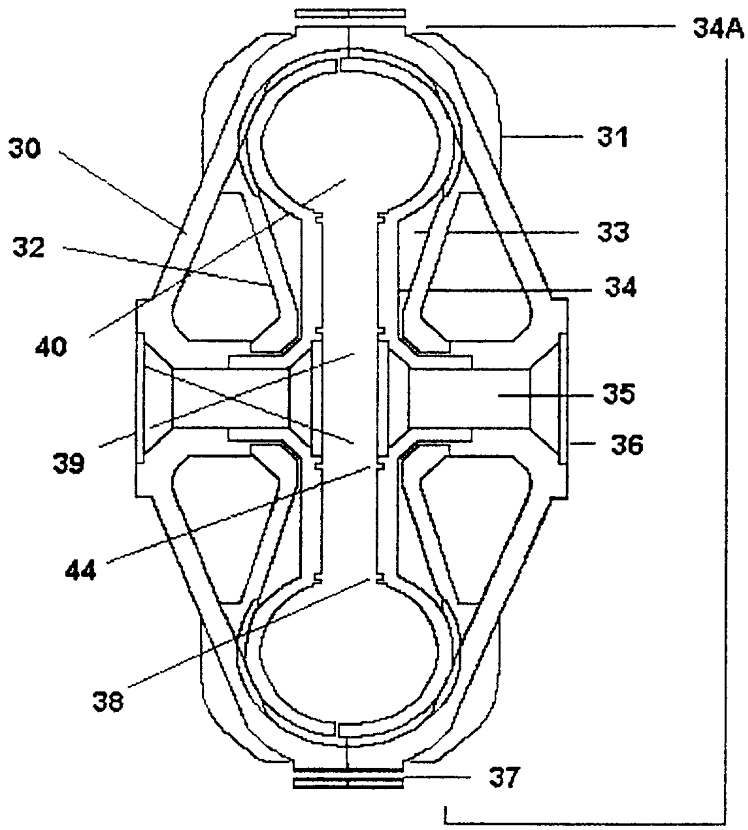

FIG. 2

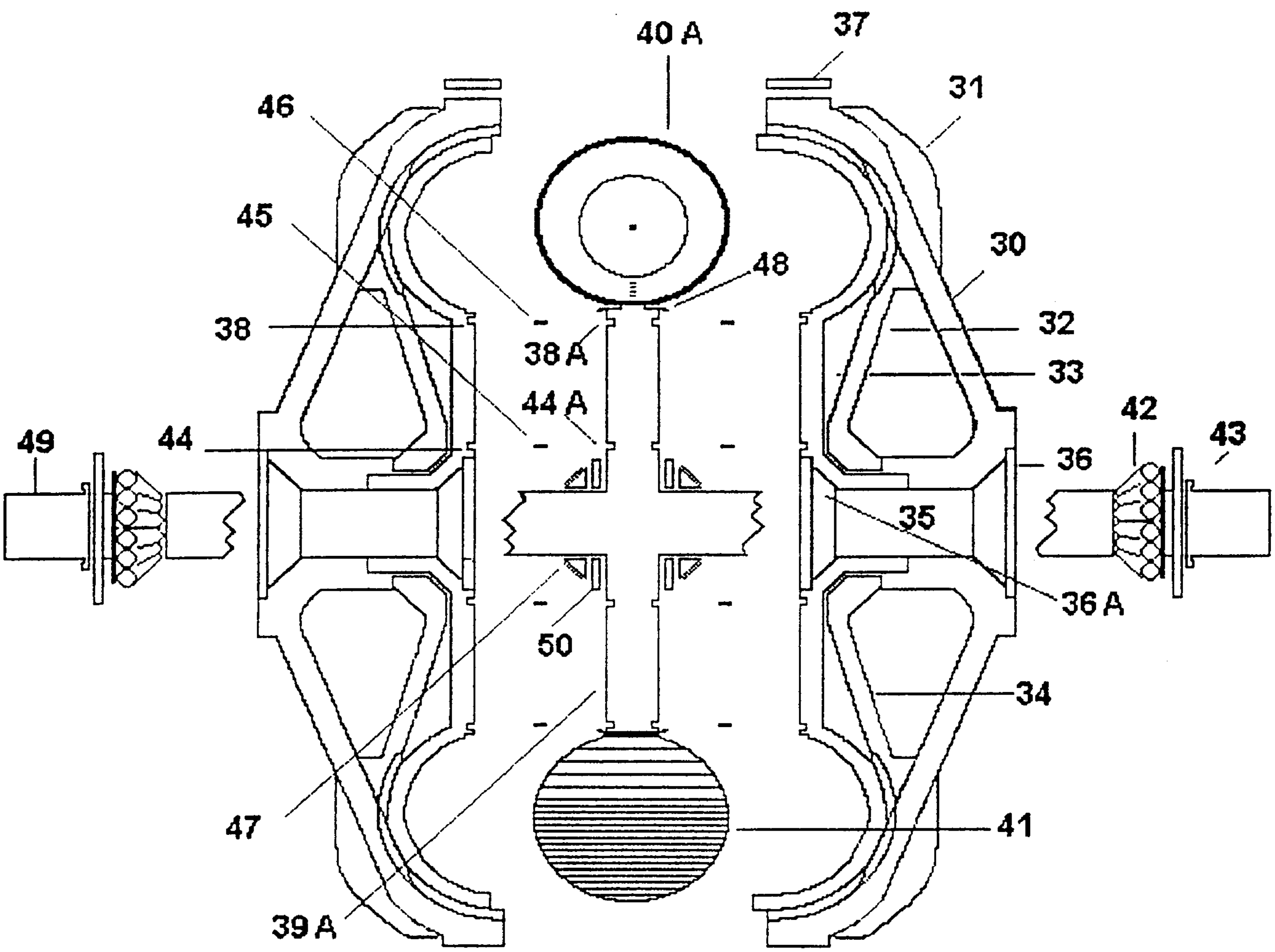
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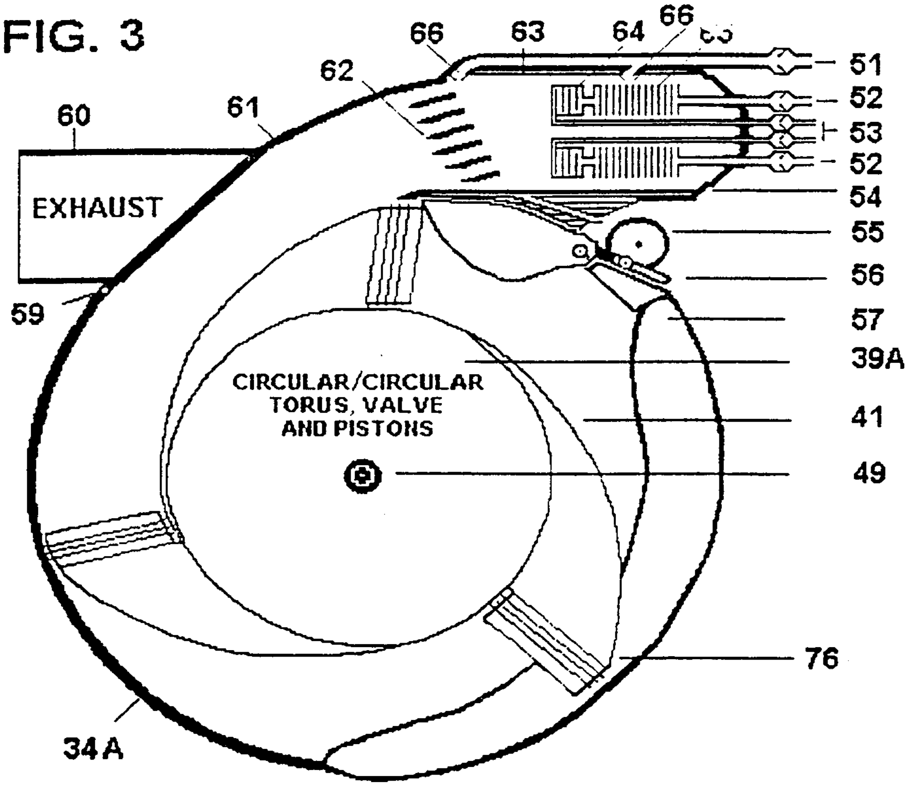
FIG. 3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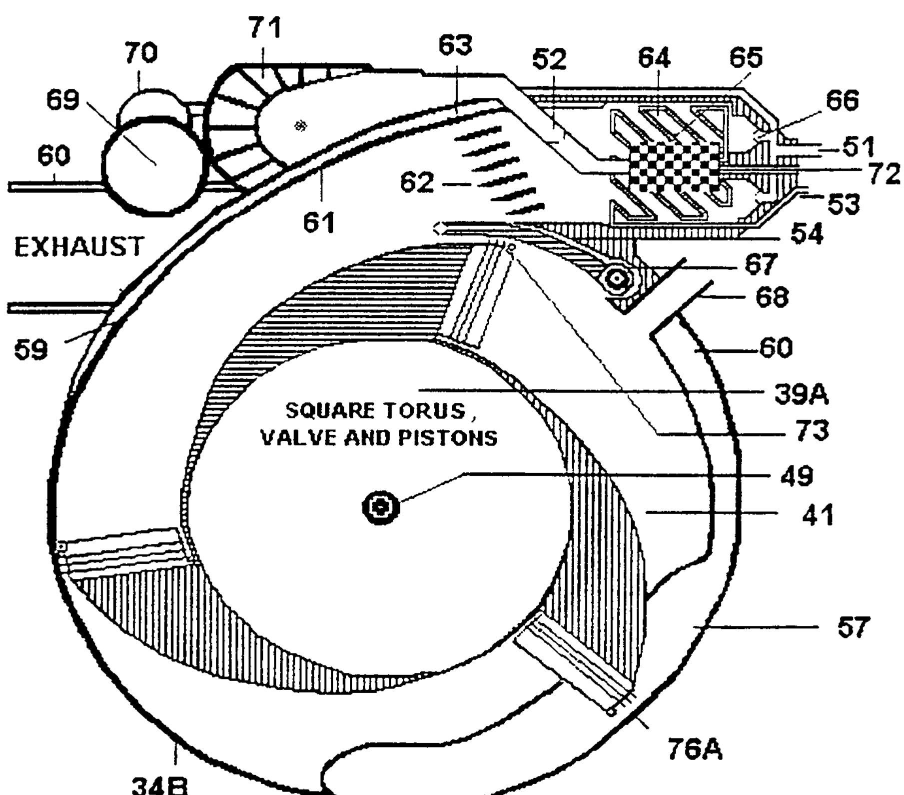
63
64
66
62
61
60
EXHAUST
59
51
52
53
52
54
55
56
57
39A
41
49
CIRCULAR/CIRCULAR
TORUS, VALVE
AND PISTONS
76
34A

FIG. 4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70
69
60
63
52
64
65
66
51
72
53
54
62
61
EXHAUST
59
67
68
60
39A
73
49
41
SQUARE TORUS,
VALVE AND PISTONS
57
76A
34B

FIG. 5

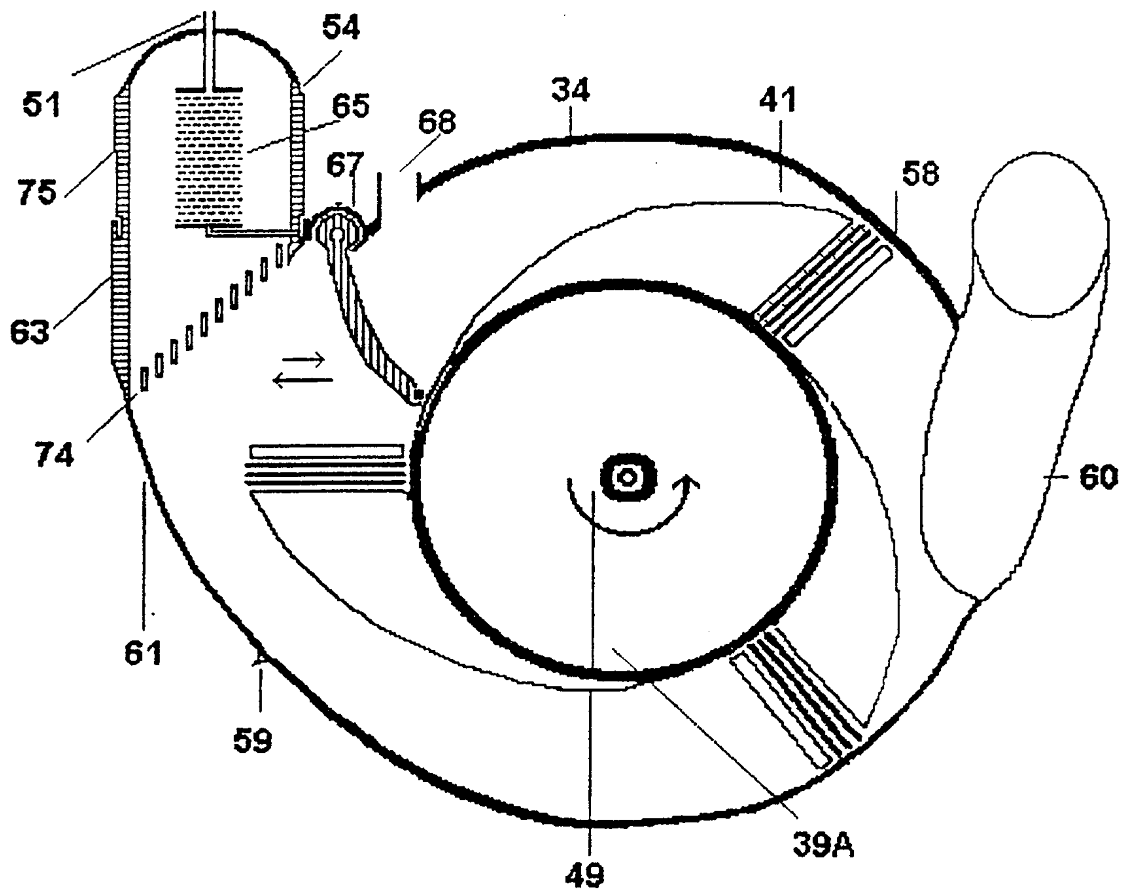


FIG. 6

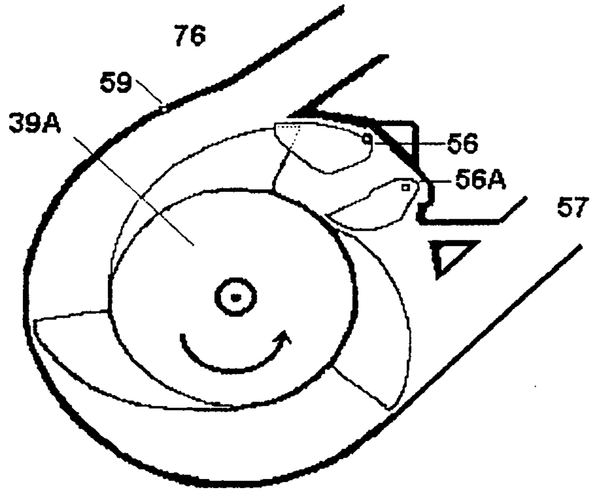


FIG. 7

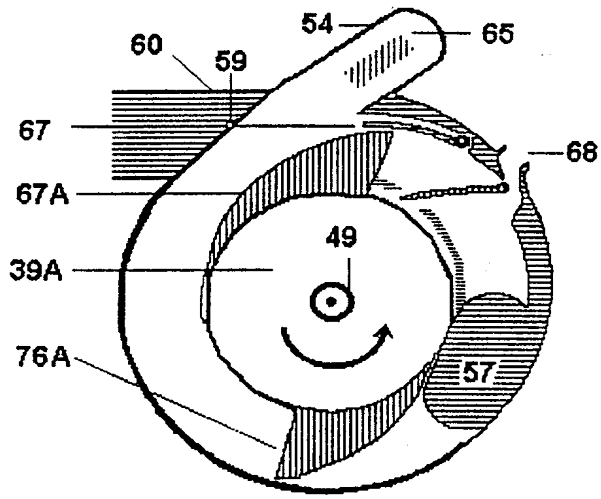


FIG. 8

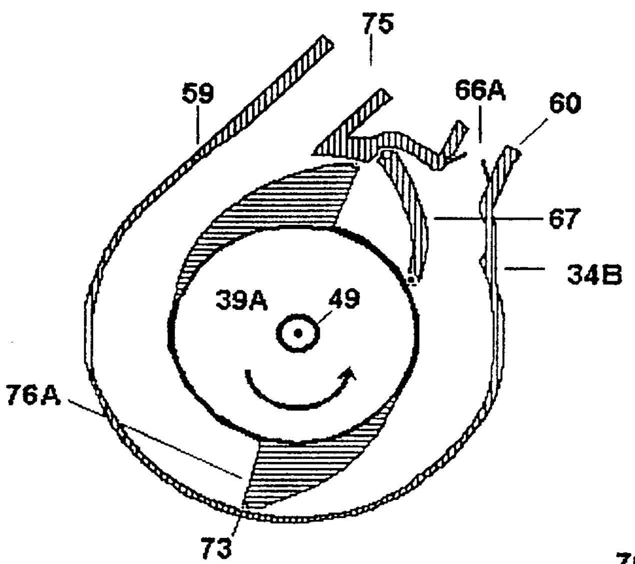
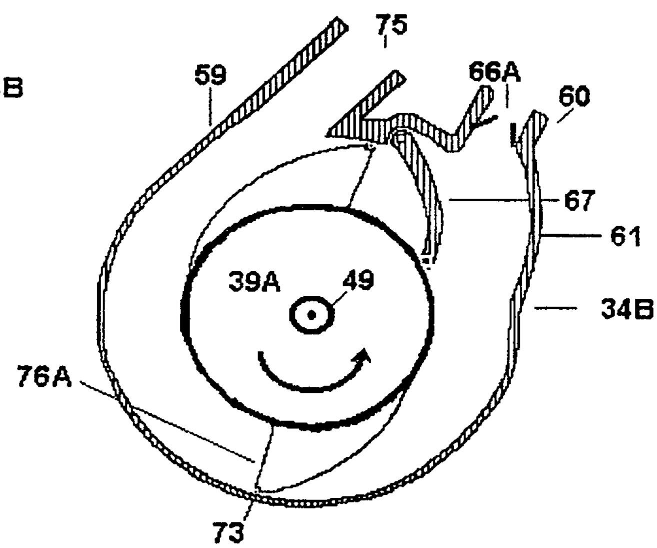
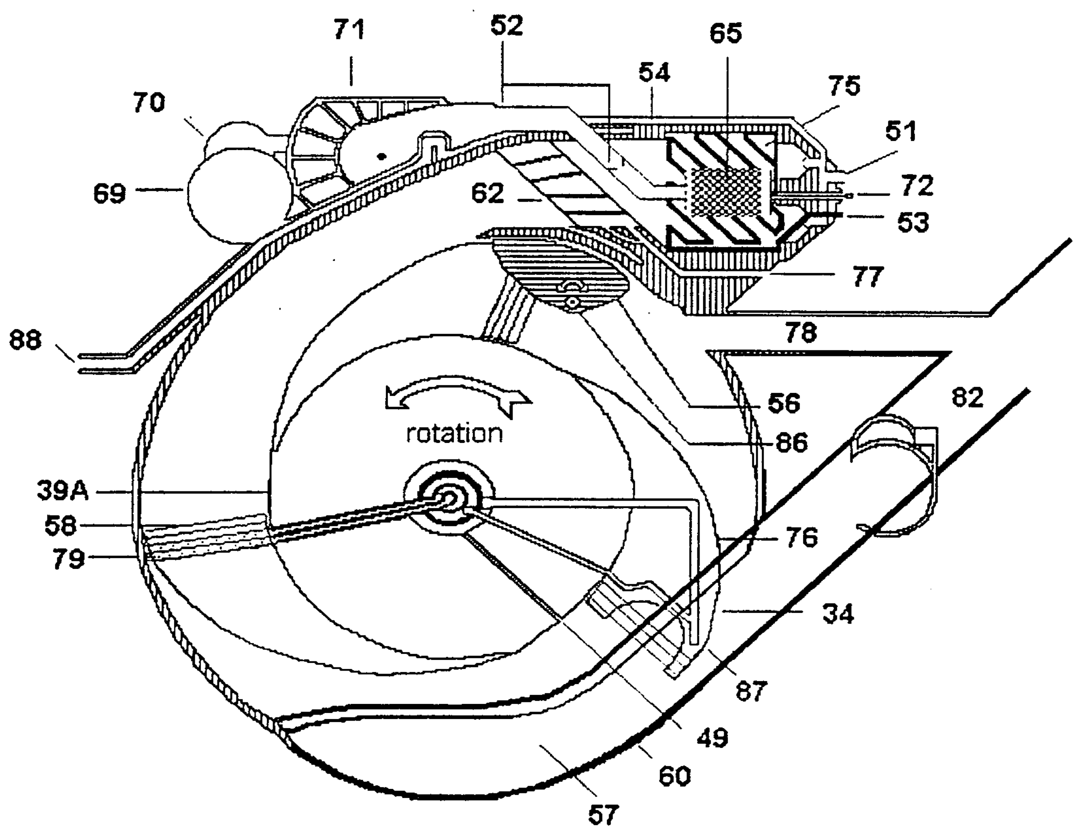


FIG. 8A

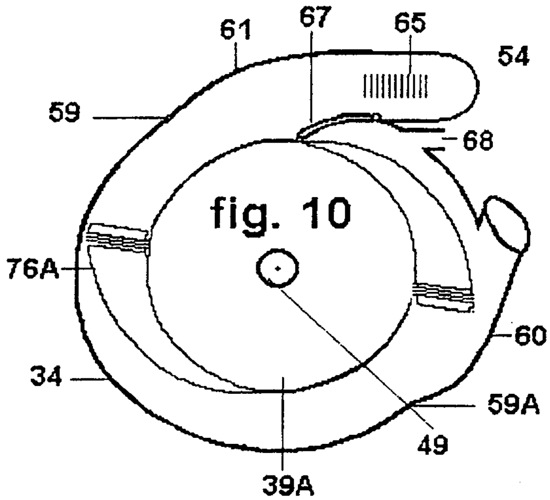


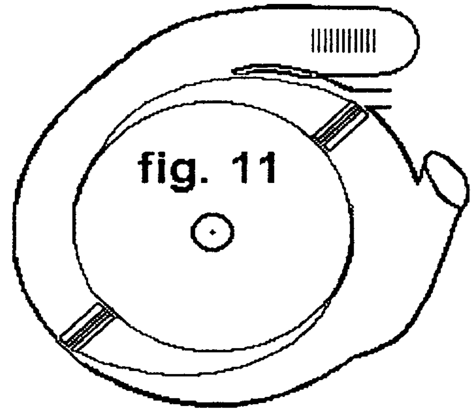
sloped back of piston may extend to
the face or top of the preceding piston

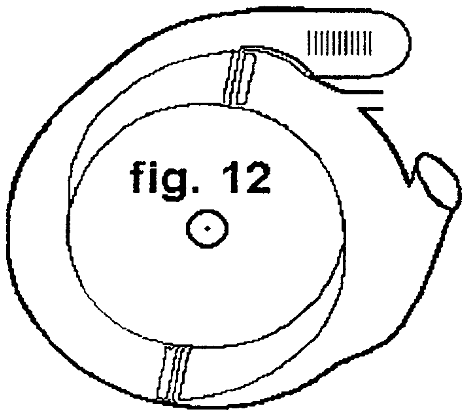
FIG. 9

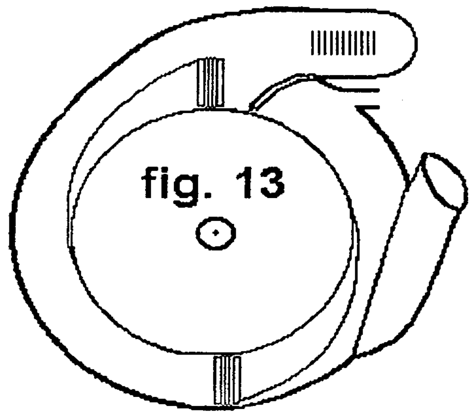

71
52
65
54
75
70
51
72
69
62
53
77
88
78
56
82
rotation
86
39A
58
76
79
34
87
49
60
57

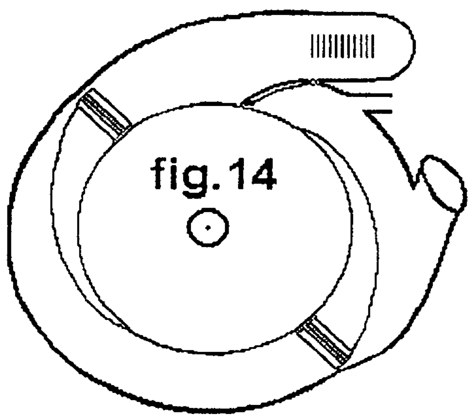
ROTATIONAL SEQUENCE











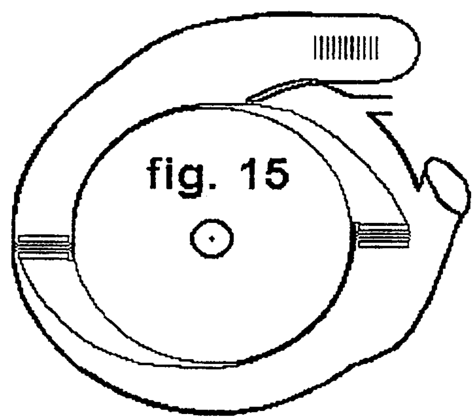


FIG. 16

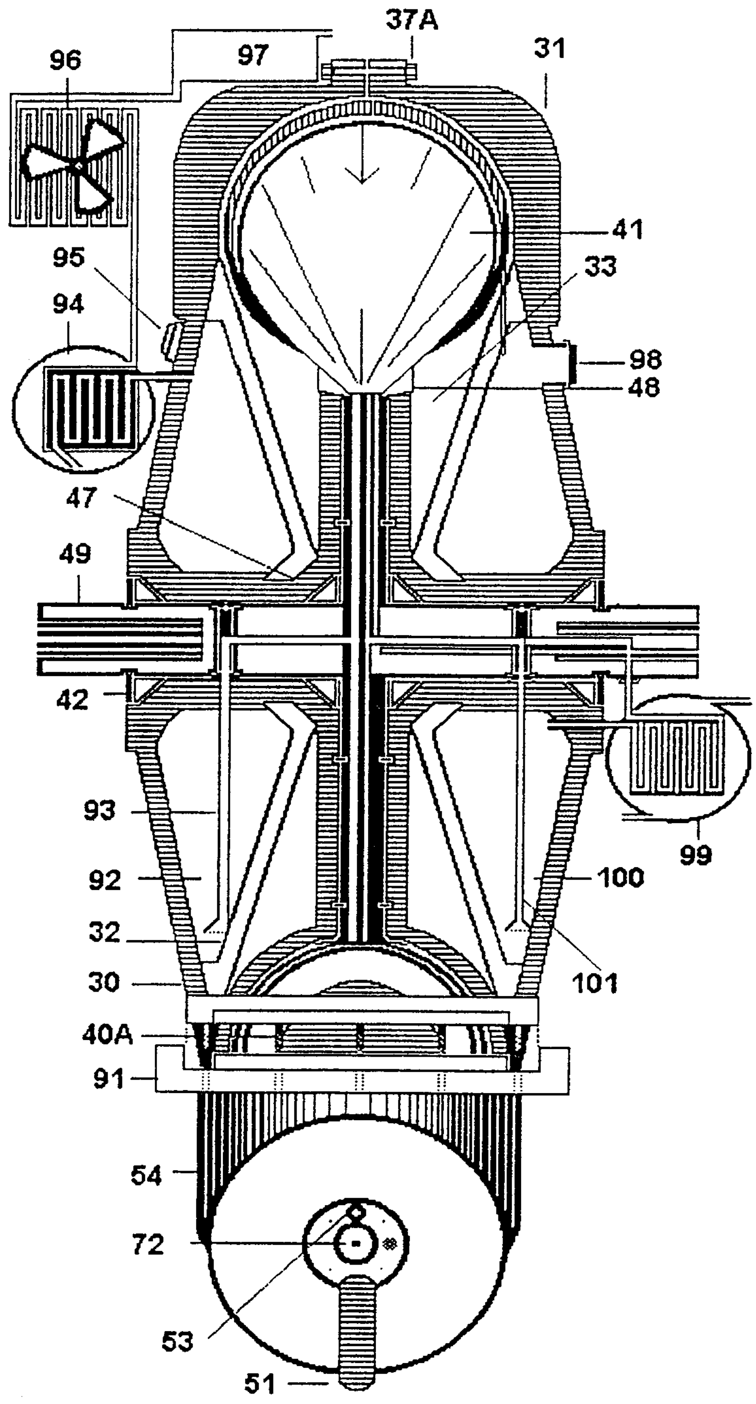
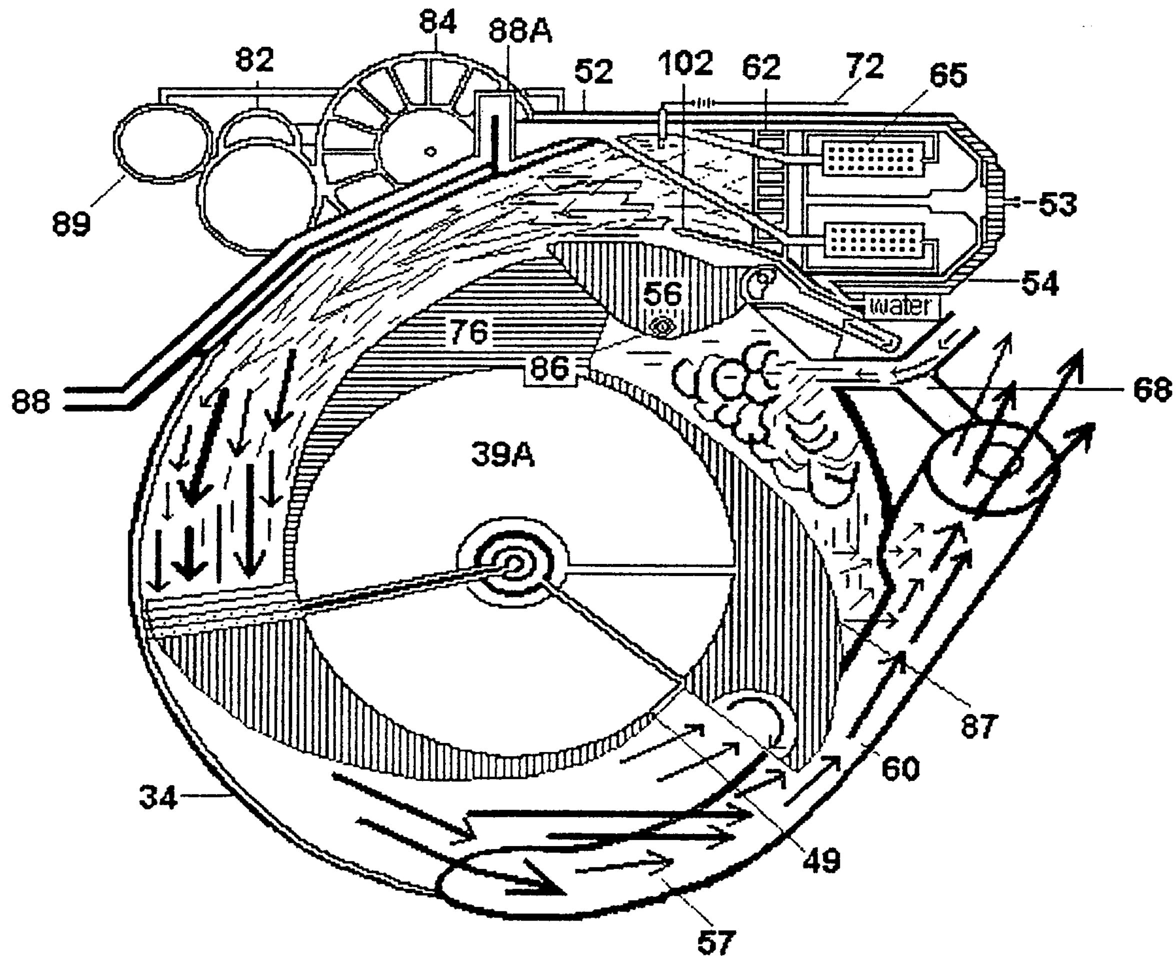

37A
31
96
97
41
33
95
94
98
48
47
49
42
93
99
92
100
32
101
30
40A
91
54
72
53
51

FIG. 17


84
88A
82
52
102
62
72
65
53
89
54
56
water
76
88
86
68
39A
87
60
34
49
57

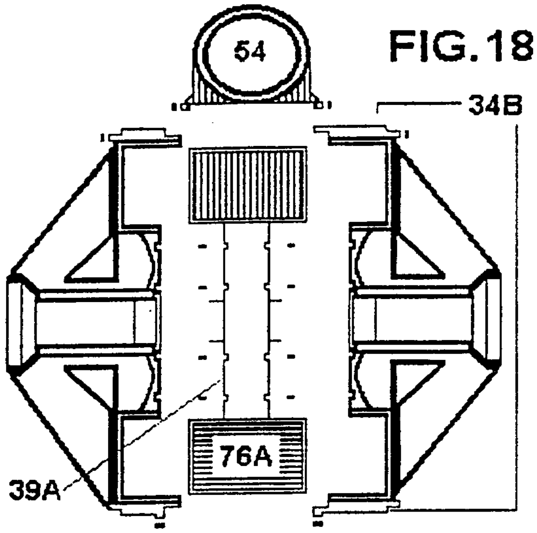


FIG.18

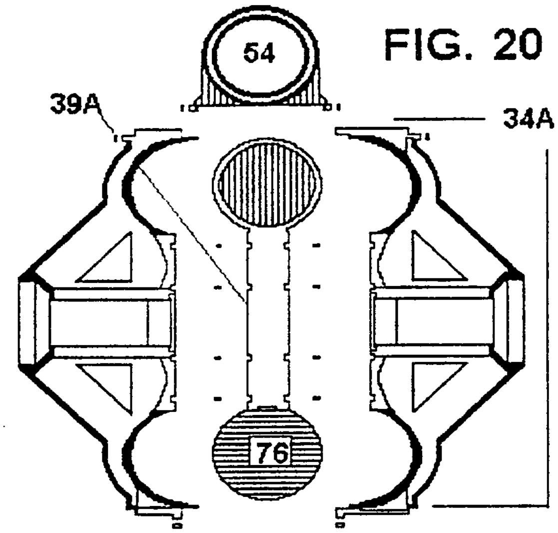


FIG. 20

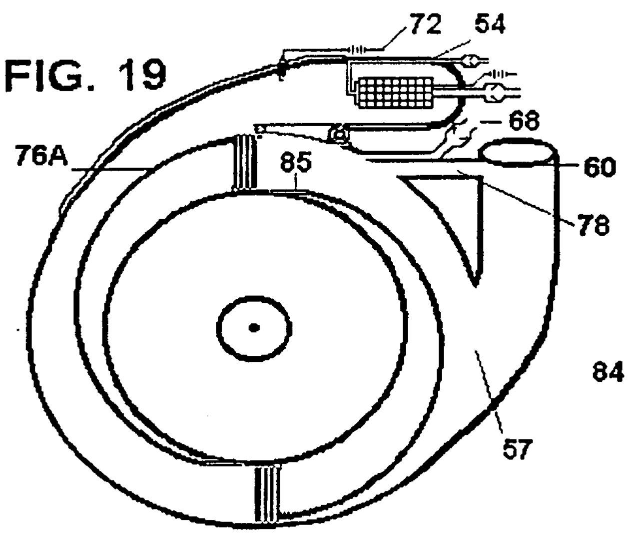


FIG. 19

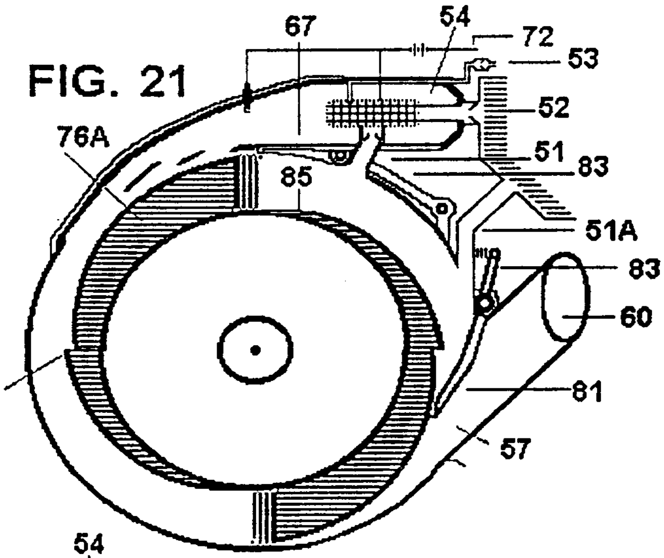


FIG. 21

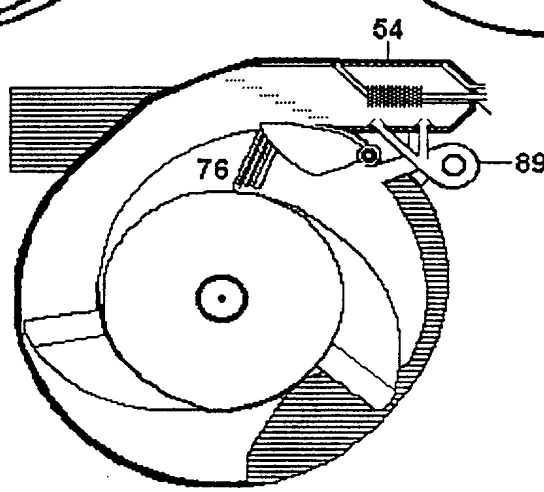


FIG. 22

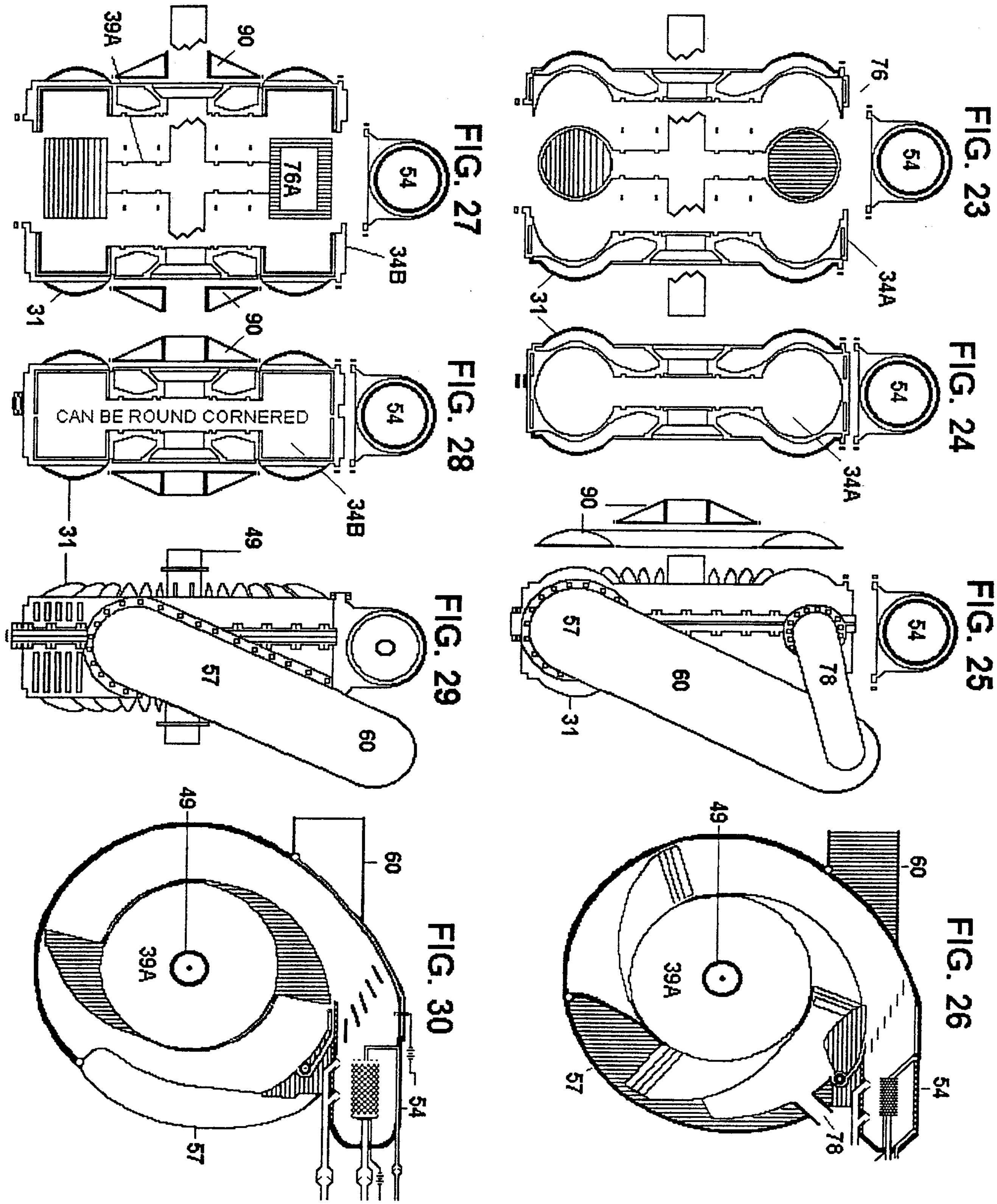


FIG. 23
54
76
34A
31
FIG. 24
54
34A
FIG. 25
54
90
57
60
78
31
FIG. 26
49
60
39A
57
78
54
FIG. 27
39A
90
76A
54
34B
31
FIG. 28
CAN BE ROUND CORNERED
54
90
34B
31
FIG. 29
49
57
60
FIG. 30
49
60
39A
57
54

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/21982

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :F02B 53/00
US CL :123/248
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 123/248, 237

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1,097,548 A (HUNTER) 19 May 1914, see the entire document.	1-3
X	US 1,369,070 A (WILLIAMS et al) 22 February 1921, see the entire document.	1-3
X	US 2,055,137 A (SHERMAN) 22 September 1936, see the entire document.	1-3
X	US 2,116,897 A (JAY) 10 May 1938, see the entire document.	1-3
X	GB 536,690 A (LANCASTER) 23 May 1941, see the entire document.	1-3
X	IT 411,611 A (PERTOLDI) 7 April 1945, see figure 10.	1-3

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 JULY 1999	27 JAN 2000

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	MICHAEL KOCZO, JR. Diane Smith for
Facsimile No. (703) 305-3230	Telephone No. (703) 308-0861

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/21982

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 4-7
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

In claim 4, the clause "with method for igniting an internal combustion engine" is not understood.
In claim 5, "means for an internal combustion engine" is not understood.
In claim 6, "means for Fluid Metering devices" is not understood.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

DERWENT-ACC-NO: 2000-329172

DERWENT-WEEK: 200028

TITLE: Rotary piston engine, pump and motor for use in an internal combustion engine comprises cylinder housing with balanced pistons with fuel supplied by high pressure fuel pump and regenerative heating/cooling with inner reaction cage

INVENTOR: VAZQUEZ J

PATENT-ASSIGNEE: VAZQUEZ J[VAZQI]

PRIORITY-DATA: 1998WO-US21982 (October 15, 1998)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE
WO 0022286 A1	April 20, 2000	EN

DESIGNATED-STATES: AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
WO2000022286A1	N/A	1998WO-US21982	October 15, 1998

INT-CL-CURRENT:

TYPE	IPC DATE
CIPS	F01C1/32 20060101
CIPS	F01C1/44 20060101
CIPS	F01C1/46 20060101

ABSTRACTED-PUB-NO: WO 0022286 A1

BASIC-ABSTRACT:

NOVELTY - The revolving piston toroidal device, engine and compressor system comprises toroidal cylinder housing assembly (34A) with balanced pistons. Fuel is supplied by high pressure fuel pump with check valves (53) and regenerative cooled/heated fuel to inner reaction cage (65) within the combustor is attached to the assembly. Gases flow through a diffuser (62) through the combustor onto the piston.

USE - For use as a rotary engine, pump and motor in an internal combustion engine.

ADVANTAGE - The engine does not utilize reciprocating motion therefore wasting energy, whilst combining positive displacement.

DESCRIPTION OF DRAWING(S) - The figure shows a side view of the three-piston round with attached combustor and inner reaction cages

Toroidal cylinder housing assembly (34A)

Check valves (53)

Diffuser (62)

Inner reaction cage (65)

CHOSEN-DRAWING: Dwg.3/30

TITLE-TERMS: ROTATING PISTON ENGINE PUMP MOTOR INTERNAL COMBUST COMPRISE CYLINDER HOUSING BALANCE FUEL SUPPLY HIGH PRESSURE REGENERATE HEAT COOLING INNER REACT CAGE

DERWENT-CLASS: Q52

SECONDARY-ACC-NO:

Non-CPI Secondary Accession Numbers: 2000-247773